

upward air current could also cause a succession of rises and falls of the hailstone, even though the upward air speed remained the same. At any rate, it is seen that variations in turbulence may be a factor in the vertical excursions of the hailstone.

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## A BRILLIANT METEOR AND ITS CLOUD-LIKE TRAIL

By S. P. PETERSON

[Weather Bureau, Albuquerque, N.Mex., Mar. 24, 1933]

An unusually brilliant meteor was observed at 5:07 a.m. on March 24, 1933, by Pilot C. W. Coyle, while flying a Transcontinental & Western Air Mail plane east from Albuquerque. At the time in question he was near Adrian, Tex., 235 miles east of Albuquerque, at a sea-level altitude of about 9,500 feet. At first it appeared as if a plane had suddenly turned on a landing light to the east of, and at an angular elevation of about 60° from, his position.

The meteor passed to the northward, seemingly at about his level, and looked like a ball of fire with pieces bursting from it, and left in its wake a great red trail tinged with blue. It disappeared to the westward and seemed to strike the earth, or disintegrate, northeast of Tucumcari, N.Mex.

The meteor also was seen by Pilot F. E. Williams when he was over Acomita, N.Mex., some 55 miles west of Albuquerque, flying a Transcontinental & Western Air Mail plane westward. Suddenly the sky was brilliantly illuminated, and on looking for the cause he saw the meteor behind him at an indefinite distance. It also was seen by several persons in Albuquerque. A very luminous cloud of bluish-green color, apparently developed by the meteoric dust, seemed to be suspended in the sky to the east-northeast of Albuquerque over the Sandia Mountains. This cloud remained visible until lost in the

light of dawn. It seems that there was some electric development in the atmosphere along the passage of the meteor, as Pilot Coyle said that the radio beam that he was following at the time was cut out by a roar of static. There was much haziness over eastern New Mexico, southeastern Colorado, and the Texas Panhandle the latter part of the 24th, practically all the 25th, and locally in those sections early on the 26th. Whether this was owing to meteoric dust or to other causes is not known. The visibility at Dilia, N.Mex., and at Tucumcari, N.Mex., was reduced to one-half mile at the time of the greatest density of the haze. This meteor attracted the Nation-wide interest of scientists, who have made an extended search for its location.

The accompanying photograph of this meteor cloud was taken at 5:30 a.m. The camera was facing toward the east and the luminous cloud was apparently resting on the crest of the Sandia Mountains. There were a few scattering stratus and strato-cumulus clouds but these were still in the shadow of the earth, while the meteor cloud was in full sunshine, as shown in the picture.

When first seen by the photographer, the luminous cloud, looking like a magnesium flare, was midway between the top of the picture and the crest of the mountains, but it gradually settled, while he was preparing his camera, to the position in which it is here shown.

## TROPICAL DISTURBANCES OF JULY 1933

By CHARLES L. MITCHELL

*June 27–July 6.*—This disturbance was first noted the evening of June 27, central in about latitude 9° north and longitude 59° west. It was the earliest known in that general area and also the only one in a record of nearly 50 years to pass south of the Island of Trinidad and over the northeastern corner of Venezuela. On the morning of June 28 the center was over the southwestern part of the Gulf of Paria. An Associated Press dispatch from Port of Spain, estimated that in the Island of Trinidad there were 13 deaths, 1,000 persons rendered homeless, about \$3,000,000 property damaged, practically all in the southern part of the island.

Through the courtesy of the United States Chargé d'Affaires at Caracas, Venezuela, the following report has been received:

*Hurricanes in eastern Venezuela.*—On June 28 a devastating hurricane swept through eastern Venezuela, the towns of Carúpano and Rio Caribe, on the mainland, and the island of Margarita suffering the most damage. Telephonic and telegraphic communications were cut for several days. Many business houses and private dwellings were destroyed, several small trading and fishing boats sunk and a number of lives lost. The losses from this hurricane alone are estimated at several millions of bolivars [1 bolivar=

19.3 cents]. During July there were several more hurricanes in the vicinity of Pedernales, at the mouth of the Orinoco, and along the river itself up as far as the Apure. However, most of them did not strike towns of any size.

During the next several days this disturbance moved first west-northwestward and later northwestward over the Caribbean Sea. It passed over extreme western Cuba the night of July 2–3, but did not cause much damage. By the morning of the 4th a strong area of high pressure, that spread southward from Hudson Bay over the eastern part of the United States, blocked the northward progress of this disturbance and deflected it toward the west. After moving westward until the evening of the 5th it turned southwestward and crossed the Mexican coast line about midway between Tampico and Brownsville, Tex., the evening of the 6th, where it caused several deaths and considerable property damage in the sparsely-settled coast region.

The usual twice-daily advisory warnings were issued in connection with this disturbance. Northeast storm warnings were ordered at noon of the 5th from Brownsville to Port O'Connor, Tex., and the warnings at Browns-

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Brooks Studio, Albuquerque, N.Mex.

Luminous meteor cloud





Photos copyrighted by Lloyd M. Long, Fairchild Aerial Surveys, Inc., Dallas, Tex.

Figure 1 first portion and figure 2 later portion of path of tornado at Dallas, Tex., July 30, 1933. Tornado moved from bottom of photo to top.



ville were changed to hurricane at 4 p.m. of the same date.

*July 14-19.*—On the morning of the 14th a minor disturbance appeared near St. Kitts, West Indies. It moved almost directly westward, passed near Jamaica on the 16th, over the Yucatan Peninsula on the 18th, and finally inland north of Vera Cruz, Mexico, the night of the 19th-20th.

*July 21-27.*—This disturbance, which also was of minor intensity, was first noted about 200 miles northwest of Progreso, Yucatan, the morning of the 21st. It moved northwestward to the coast of Texas, then inland near Matagorda Bay the night of the 22d-23d, and finally dissipated near Memphis, Tenn., during the 27th.

*July 25-August 5.*—This disturbance was centered a short distance southeast of the Island of Antigua, West Indies, the morning of the 25th. It passed south of St. Thomas the following night, causing a wind velocity of 60 miles per hour from the northeast. Continuing west-northwestward its center passed north of Puerto Rico on the 26th and almost over Turks Island on the 27th. The lowest barometer reading at Turks Island was 29.37 inches, accompanied by a wind velocity estimated as 85 miles per hour from the northeast. The disturbance moved northwestward during the 27th-28th, then west-northwestward over the northern Bahamas. The center crossed the coast line of Florida a short distance south of Fort Pierce on the 30th, accompanied by a wind at that place of 60 miles per hour from the southeast. However, no great amount of damage resulted as the disturbance moved westward over the Florida Peninsula and passed into the Gulf of Mexico

between Tampa and Fort Myers. Storm warnings were displayed on the east Florida coast from Miami to Titusville and on the west coast from Tarpon Springs to Punta Rassa.

This disturbance continued to move westward but vessel reports on the 1st and 2d indicated a decrease in intensity. From the morning of the 3d until the center passed over the coast line near Brownsville no vessel reports were received near or west of the center, and it was impossible to indicate accurately its position or intensity. However, advices were issued twice daily giving estimates of its position and probable movement until noon of the 3d when storm warnings were ordered for the Texas coast between Freeport and Brownsville. On the evening of the 3d Texas stations were advised that the center probably would reach the south Texas coast between Brownsville and Corpus Christi and be attended by strong shifting winds, possibly reaching gale force near the center with moderately high tides from Port O'Connor southward to Brownsville. The advices on the morning of the 4th were that the center would cross the Texas coast between Corpus Christi and Brownsville, but somewhat nearer Brownsville, and that winds would reach gale force over a very small area but probably would not attain hurricane velocity. The center crossed the coast nearly over but slightly south of Brownsville during the early night of the 5th with greatly increased intensity, the highest velocity being 72 miles at Brownsville. No doubt the increase in intensity began as early as the 4th. Considerable damage was caused in the vicinity of Brownsville and over a strip westward to Monterey, Mexico, owing largely to torrential rains.

## THE DALLAS, TEX., TORNADO OF JULY 30, 1933

By GORDON E. DUNN<sup>1</sup>

[Weather Bureau, Washington, August 1933]

A tornado struck the Oak Cliff section of Dallas, Tex., about 4:15 p.m., eastern standard time, July 30, 1933. It moved from south-southeast to north-northwest for a distance of about 2 miles, killing 4 persons, injuring about 30, and effecting a property loss estimated at \$500,000, though over part of its path there was little or no damage.

This tornado occurred in connection with a rather severe thunderstorm, but the pressure distribution was decidedly of a nontornadic type. On the 28th and 29th a rain area moved steadily northward from the West Gulf coast, reaching Dallas early on the 30th, but attended by no surface cyclonic circulation. The rainfall ranged from 4 to 6 inches in northern Texas and southern Oklahoma. The 5 a.m. airplane flight at Dallas on the 30th showed a weak lapse rate with rather high temperature to top of flight with a very high relative humidity—100 percent over a considerable portion of the vertical air column—and, of course, high absolute humidity. Twenty four hours later the lapse rate was still about the same, but the relative and absolute humidity had greatly

decreased. The upper-air map was rather blank over this area owing to extensive cloud cover, but on the evening chart Dallas reported the highest wind velocity east of the Rockies, 36 miles per hour from the south-southwest at 8,000 feet and 45 to 47 miles from 3,000 to 6,000 feet. There was some slight evidence of cyclonic circulation aloft.

The accompanying aerial photographs taken of the wreckage of this storm by the Fairchild Aerial Surveys, Inc., of Dallas, and kindly furnished by them for use in this article, present a clear and unusual picture of the trail of a tornado. The serpentine path, rotation, and explosive effects are clearly evident. The direction of rotation is less evident, but Mr. J. A. Riley in his personal inspection of the storm area says, "there appears very strong evidence that the rotation was counterclockwise." Figure 1 shows the area of major destruction beginning shortly beyond the place where the tornado first touched ground. Between the areas covered by figures 1 and 2 there is a vacant lot where for one quarter mile little damage could be done. In figure 2 the serpentine path is clearly shown. The tornado continued on beyond this area for a short distance with little damage.

<sup>1</sup> Based on a report by Mr. J. A. Riley, official in charge, Weather Bureau Airport, Dallas, Tex.